AUTOMATION®
ARMDROID 1000
MODEL DM-5100

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GENERAL DESCRIPTION

The Armdroid 1000 provides complete and affordable training in the programming and operation of industrial style robots.

Through the curriculum and hands-on experience gained in working with the Armdroid 1000, students learn to create automated work cells ideal for flexible manufacturing systems (FMS) and computer inte-grated manufacturing (CIM).

A precision-built, joined arm (articulated) micro robot, the Armdroid 1000 represents an important step forward in automation and handling.

A stepper motor located in the base of the unit provides horizontal rotation while five additional stepper motors with open loop control located in the shoulder provide precision movements of special-ized components. The continuous path robot has five axes of rotation and is able to use several joints simultaneously to perform a programmed move sequence. Movement of the elbow joint, wrist, and gripper mechanisms is accomplished by cables and belts through a series of gears and belt-driven pulleys.

The base of the unit includes one connector for an external stepper motor which can be used for further experimentation, such as operating the Linear Slide 1000 or Rotary Carousel 1000. The robot has four external device control connections, one of which is mounted on the shoulder and three of which are mounted in the base.

Software-supported accessory devices, which operate at the same supply voltage as the Armdroid 1000, include a Magnetic Gripper and Vacuum Gripper.

A software-sup-ported feedback line is included among the unit's output lines to enable the robot to operate in a wait state via an external sensor.

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STRUCTURAL FEATURES

Base
The base supports the arm mechanism and houses the printed circuit control boards and motor that provides power to the rotation of the shoulder. A mechanical stop on the base prevents over-rotation of the shoulder.

Shoulder
Rotating on the base, the shoulder houses the five motors associated with the gears and belts that move the other parts of the arm. Horizontal movement spans 180 degrees in either direction from the home position. A mechanical stop prevents the shoulder from over-travel.

Upper Arm
Attached to the shoulder, the lower end of the upper arm carries the gears and pulleys that drive the elbow, wrist, and gripper. Driven by its own stepper motor and pivoting from the shoulder joint, the upper arm contains gears that mesh with the reduction gears of the shoulder to provide up and down movement at a maximum of 180 degrees.

Forearm
The forearm attaches from the elbow joint and extends to the wrist, moving a maximum of 270 degrees up or down. The structure of the forearm allows the gripper pulley block, housed in the forearms center, to move back and forth, which opens or closes the gripper.

Wrist and Gripper
The wrist and gripper work together to pick up items and move them to a programmed location. The wrist moves up or down to control the two-fingered gripper that can rotate in a 360 degree clockwise or counterclockwise direction.
The fingers of the gripper, which are fitted with rubber tips that enable it to grab onto items with smooth surfaces, move in an “open” or “close” motion. The wrist gears are moved by drive belts attached to gear and toothed belt assemblies using two dedicated wrist stepper motors. The gear assemblies of the stepper motor can be moved in opposite directions from one another to cause the gripper to roll or twist, or they can be moved in the same direction to pitch the gripper in an up or down direction.

TEACH PENDANT 1001
The Teach Pendant 1001 is directly connected to the Armdroid 1000 via the interface control box. It has a 4-line, 20-character LCD display and is based upon a 68HC11 system operating at 9 MHz, with 32K ROM and 32K RAM. The Teach Pendant has a serial port for uploading and downloading a point program to a computer. The interface box has standard tip jacks for 6TTL inputs, and 2 interrupt lines on the interface box (one for the system and one for safety.)

TEACH PENDANT FEATURES
- 4-line, 20 character command and message display
- 68HC11-based, operating at 9 Mhz with 32K ROM and 32K RAM
- Level 2 VAL type tasking program
- Standard tip jacks for 4 TTL compatible outputs on the robot base, 6 TTL compatible inputs, and 2 interrupt
lines in the interface box

LEVEL 2 SOFTWARE
Level 2 software for the Armdroid robot provides a basic introduction to robotic workcell programming.

LEVEL 2 SOFTWARE FEATURES
- Easy to use menu-driven software
- Can be used to replace Teach Pendant for robot control
- Direct keyboard control over all robot axes and func-tions
- Create, save, edit, and delete robot movements as points
- Tasks can perform basic flow control, including jumps,loops, and if-then-else conditions
- Control robotic output ports and read input channels
- Save and load tasks and points to diskette
- Number of points and length of task limited only by conventional memory

COMPUTER REQUIREMENTS
- IBM 386 compatible or better
- MS-DOS 5.0
- MS Windows 95 or MS Windows NT 3.51 or 4.0
- 8 MB RAM
- VGA monitor
- 3.5” floppy disk drive or 2X CD-ROM drive
- Hard drive with 15MB of free space
- 1 Serial (RS-232) port for download
- 1 Parallel port (optional)

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ROBOT COURSEWARE

Basic instruction in D&M robotics involves step-by-step directions in the setup and operation of the Armdroid 1000. These directions are provided in a user's manual.

- Introduction to Robotics
- Mechanical & Electronic
- Computer Interfacing
- Care and Maintenance
- Menu Usage
- Three Finger Gripper
- Two Finger Gripper
- Magnetic Gripper
- Vacuum Gripper
- Delay Interfacing
- Linear Slide
- Carousel
- Conveyor
- Pneumatics
- Relay
- Teach Pendant
- Repair

that enables students to get started immediately and includes the following topics:

LEVEL 2 CURRICULUM

Advanced instruction in the concepts and operations involved in robotics and flexible manufacturing systems (FMS) for the Armdroid 1000 is offered through the optional Robotics Level 2 Modular Curriculum. Corresponding with the Level 2 robot software, the Robotics Level 2 Modular Curriculum includes a pretest and post-test and covers the following activities or topics:

- Programming a Robot
- Create and Store a Robotics Program
- Programming Involving Obstacles in the Wo r k Envelope
- Varying Speed Rates
- Editing a Program
- Industrial Activity Simulation
- Simulate a Welding Assembly Operation
- Define a Wait Point
- Combining Common Primary Commands
- Create an Industrial Activity Program
- Create a Shell Game
- Programming Using Control Points
- Using the Rotary Carousel
- Program Using Gravity Feeder Conveyor Belt and Ultrasonic Cleaner

Stepper Motors

The Armdroid 1000 stepper motors take 200 steps per revolution at 1.8 degrees per step motion.

MECHANICAL SPECIFICATIONS

Mechanical Arm
Construction.....Articulated arm
Number of axes.....5 plus gripper
Load capacity.....26 oz
Resolution.....0.11 in
Speed.....Programmable within the speed range
Maximum speed.....9 in /sec
Actuators.....6 DC stepper motors with open loop control

WORKING ENVELOPE

Base .....320°
Shoulder joint.....180°
Elbow joint .....180°
Pitch joint .....270°
Roll joint .....360°
Transmission....Gears and timing belts
Weight .....8.3 lb